ALIGNMENT PLATE FOR ALIGNING CONNECTOR TERMINALS

FIELD OF THE INVENTION

[0001] The invention relates to a connector assembly comprised of a socket and plug assembly, particularly for automotive use.

BACKGROUND OF THE INVENTION

[0002] Automotive connection systems exist in the form of socket and plug connectors, where the socket connector includes a plurality of upstanding pins and/or tabs to provide a plurality of signal and/or power lines to various parts of the automobile. Many times harnesses must be assembled and/or preassembled, where one part of the connector is not mated with the corresponding connector until some time further in the overall automobile assembly process. Thus, this requires a great deal of care for socket connectors of the type having a header and a plurality of upstanding tabs and/or pins.

[0003] In some connection systems, the headers are provided with free-standing pins without any type of support surrounding the pins. In other connection systems, alignment plates are provided but are cumbersome in nature, as they add overall height to the socket connector. In other words, adding a vertical dimension of an alignment plate requires the overall height of the socket to increase, thereby increasing the overall material cost, as well as the area required to house the connection system.

[0004] Thus, the object of the invention is to provide the advantages of the alignment plate and the overall protection which it provides with a low-profile outline of a connection system.

[0005] The objects of the invention have been accomplished by providing an electrical connector comprising an insulative housing and a plurality of terminals. The housing provides a protective shroud around the terminals. An alignment plate is movable along the terminals in a mating direction of the terminals when mated with a complementary electrical connector. The terminals

being mounted in an array on a printed circuit board, with the housing being attached to the printed circuit board. The alignment plate is movable from a first position adjacent to free ends of the terminals, to a second position adjacent the printed circuit board.

[0006] The connector further comprises locating elements on the alignment plate and on the protective shroud to position the alignment plate relative to the terminals. The locating elements can comprise locating lugs on the alignment plate, and channels surrounding a perimeter of the protective shroud profiled to receive the lugs. The alignment plate also includes stand-off features to hold the plate portion of the alignment plate slightly up off of said printed circuit board.

[0007] The electrical connector further comprises a latching element to latch the alignment plate in the first position. The electrical connector can also further comprise posts extending upwardly from the alignment plate for alignment with a complementary connector when mated to prevent misalignment.

[0008] In another aspect of the invention, an electrical connector assembly, comprises a socket connector comprising a plurality of socket terminals being mounted in an array on a printed circuit board; an insulative socket housing providing a protective shroud around the terminals; and an alignment plate being movable along the terminals in a mating direction of the terminals, the alignment plate being movable from a first position adjacent to free ends of the terminals, to a second position adjacent the printed circuit board. A mating plug connector comprises a plug housing profiled for mating reception in the protective shroud; and a plurality of plug terminals electrically connectable with the socket terminals.

[0009] The socket terminals are profiled as a plurality of posts upstanding from the printed circuit board. The plug housing has a front mating face with apertures complementarily located to receive the socket posts. The alignment plate further comprises insulative aligning posts upstanding therefrom and extending outwardly, and the plug housing front mating face including alignment openings to receive the aligning posts. The aligning posts extend out a distance greater than the socket terminal posts.

[00010] The plug and socket connectors have latching detents cooperatively provided on the socket and plug housings to temporarily hold the housings together in an unmated condition. The detents are provided on exterior endwalls of the plug housing, and on interior endwalls of the socket housing. The detents are so positioned on the socket and plug housings such that when the housings are held by the detents, the aligning posts are partially inserted in respective alignment openings, but the socket and plug terminals are disengaged.

[00011] The electrical connector assembly further comprises a latching assembly cooperatively provided by the socket housing and the alignment plate to latch the alignment plate in the first position. The plug housing includes a disengagement element to disengage the latching assembly, to allow the alignment plate to be moved to the second position by the movement of the plug housing.

[00012] In yet another embodiment of the invention, an electrical connector, comprises a plurality of socket terminals being mounted in an array on a printed circuit board; an insulative shroud around the terminals; and an alignment plate being movable along the terminals in a mating direction of the terminals, the alignment plate being movable from a first position adjacent to free ends of the terminals, to a second position against the printed circuit board.

[00013] The electrical connector further comprises locating elements on the alignment plate and on the protective shroud to position the alignment plate relative to the terminals. The electrical connector further comprises a latching element to latch the alignment plate in the first position. The electrical connector further comprising posts extending upwardly from the alignment plate for alignment with a complementary connector when mated to prevent misalignment.

BRIEF DESCRIPTION OF THE DRAWINGS

[00014] Figure 1 is an exploded view of the socket and plug connector housings;

[00015] Figure 2 is a view similar to that of Figure 1 from a below different perspective;

[00016] Figure 3 is a cross-sectional view through lines 3-3 of Figure 1 showing the module housing and alignment plate in cross section;

[00017] Figure 4 is a perspective view of the plug housing from a perspective showing the end wall in greater detail;

[00018] Figure 5 is a cut-away view of the printed circuit board, module housing and alignment plate;

[00019] Figure 6 is a cross-sectional view through lines 6-6 of Figure 5;

[00020] Figure 7 is a view similar to that of Figure 5 showing the plug housing poised for receipt within the module housing;

[00021] Figure 8 shows a perspective view of the plug housing cooperating with the latches on the alignment plate, but less the module housing and printed circuit board; and

[00022] Figure 9 shows a view similar to that of Figure 8 showing the plug housing in the fully latched position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[00023] With reference first to Figure 1, a socket housing assembly is shown at 2 as an exploded view, which is profiled to receive a plug assembly shown generally at 4. The socket housing 2 is comprised of a printed circuit board assembly 6, a module housing 8, and an alignment plate 10. With respect now to the various drawings, the individual components will now be described in greater detail.

[00024] With reference to Figures 1 and 2, the printed circuit board assembly includes a printed circuit board 12 having mounted thereon, an array of terminals, for example, large tab terminals 14, tabs 16, and pin contacts 18. It should be appreciated that the various tabs 14, 16 and pin contacts 18 can be connected to traces on the circuit board for interconnection to other various components in a known manner. For example, the printed circuit board 12 could include edge traces to which edge card connectors are connected to printed circuit board 12, or other pin contacts could be established in another array for interconnection to the contacts 14-18.

[00025] As shown in Figures 1 and 2, the module housing 8 generally includes an open frame wall 20 including end walls 22, 24 and side walls 26 and 28. The module housing 8 further includes a lower flange portion 30, which circumscribes an interior opening 32 within the module housing 8, as will be described herein. As shown best in Figure 2, module housing 8 includes two alignment ribs 36 positioned on an inside of wall 26, and two alignment ribs 38 positioned adjacent to wall 28, as will be described further herein. As also shown in Figure 2, module housing 8 includes alignment channels 40 at one end and channels 42 at the opposite end, both sets of channels being positioned within an inside surface of wall 26 and 28, respectively.

[00026] With respect now to Figure 3, which is a cross-sectional view through lines 3-3 of Figure 1, an inside view of wall 24 is shown to include two elongated alignment ribs 44, which flank a detent member 46, having ramped surfaces 48 and 50, and a latch projection 52 having a ramped surface at 54 and a horizontally extending latch surface 56. Two latched detents 60 are also

provided having a ramp portion at 62, which enlarges to an upstanding portion at 64. The enlarged portion 64 has a V-shaped upper surface at 66 and lateral projections extending therefrom at 68.

[00027] With respect now to Figures 1 and 3, alignment plate 10 is shown in greater detail as including a plate portion 70 having upstanding anti-scoop members 72 and a plurality of passageways through the plate, for example, at 74, 76, and 78. It should be appreciated that the apertures 74 are profiled to receive tabs 14; apertures 76 profiled to receive tabs 16, and apertures 78 profiled to receive pins 18. As shown now in Figure 3, alignment plate 10 further includes two flexible spring arm latches shown generally at 80, where the latches are comprised of upstanding spring arms, for example, at 82 and 84. It should be appreciated that the latch arms 82, 84 are identical to each other but a mirror image of each other. As shown in Figure 3, spring arms 82, 84 include ramped surfaces at 86, lower locking surfaces 88, and an outer overlapping wall at 90. Alignment plate 10 also includes an intermediate flexible latch 94 including two upstanding leg portions 96 and a horizontal bar section at 98. It should be appreciated that the alignment plate has latches 80 and 94 at each end of the plate, as shown in either of Figures 1 or 2. Finally, as shown in Figure 1, alignment plate 10 includes locating lugs at 100, 102. As shown best in Figure 8, lugs 100, 102 provide laterally extending portions 104, 106 and standoff surfaces 107, 108.

[00028] As shown in Figure 4, plug housing 4 is shown in greater detail as having general side walls at 110, 112 and end walls 114, 116. Socket housing 4 further includes a top wall 118 and a lower wall 120 (Figure 2) having apertures 124, 126, and 128, where apertures 124, 126, and 128 are profiled to receive respective terminals 14, 16, and 18. Side wall 110 includes an alignment rib 130 and wall 112 includes a similar rib (not shown), and wall 110 includes spacer ribs at 132; and end wall 116 includes spacer ribs at 134. Each end wall 114, 116 includes a central detent member 140 having upper and lower ramp surfaces 142 and 144. Furthermore, both end walls 114 and 116 include a pair of diamond-shaped projections 150, where each projection includes upper surfaces 152 having little slope and surfaces 154 having a large slope, as will be described

herein. Finally, upper surface 118 and lower surface includes openings 160 extending therethrough, and which are profiled to receive anti-scoop prot ction members 72. With the above description of the various components, the assembly of the connectors will now be described herein below.

[00029] With reference first to Figure 6, the printed circuit board is shown with the various tabs (only tabs 14 are shown) positioned within cavity 32 and with alignment plate 10 shown partially inserted therein. As shown, alignment plate 10 has tabs 14 partially inserted within apertures 74. Alignment plate 10 is also shown fixed in a preliminarily locked position by way of latch members 80 and 94. More particularly, latch shoulders 90 (Figure 3) are hanging on the V-shaped surface 66 (Figure 3) and bar portion 98 of latch 94 is snapped beneath latch surface 56. It should be appreciated from Figure 6, however, that the resilient arms 82, 84, particularly at the position of surfaces 86, has a greater depth or thickness than latch body portion 64. When in the position of Figure 6, plug housing 4 can be positioned within cavity 32 such that apertures 160 align in all three axes with anti-scoop features 72 to align the plug housing 4 with the socket housing 2 prior to any engagement with the various tab contacts. As best shown in Figure 7, it should be clear that the anti-scoop features extend higher than any of the tab contacts 14, 16, 18.

[00030] With respect now to Figure 8 (which is shown without the printed circuit board 6 and housing 8), continued movement of the plug housing causes diamond-shaped lugs 150 to engage surfaces 86 of flexible latch arms 82 and 84. Further movement downward of plug housing 4 causes outward rotation or bowing of arms 82 and 84 such that plug housing 4 moves from the position shown in Figure 8 to the position shown in Figure 9. When in the position of Figure 9, the standoff surfaces would contact the printed circuit board in a bottom-out position. It should be appreciated that the printed circuit board and tab contacts may have solder fillets, and the standoffs prevent the alignment plate 10 from sticking to the fillets. The lugs also provide stability generally to the alignment plate, and help prevent the alignment plate from binding in the socket housing 8.

[00031] Furthermore, as mentioned above, the slope of the ramped surfaces 152 (Figure 4) is much less than that of surfaces 154. The slope of surfaces 152 is chosen such that the force to extract the plug connector from the position of Figure 9 is greater than the sum of the forces to withdraw the plug housing as it relates to the frictional engagement of the various contacts. Thus, during the first portion of the retraction of the plug connector 4, the alignment plate is also retracted back to the position shown in Figure 6. Continued retraction of the plug housing 4 causes the interference of surfaces 152 (Figure 4) and surfaces 88, again spreading the arms 82 and 84 apart, allowing the full retraction of the plug housing 4.

[00032] In the preferred embodiment, the insertion and retraction mechanism can be a rack and pinion system including a rotatable lever member on posts 70, which is cooperable with rack teeth 172, although any type of assist feature could be employed. It should also be noted that the connector assembly could also be hand mateable, where the plug and socket connectors are merely pushed together by hand.

[00033] Advantageously then, and as best shown in Figure 6, the design offers a simplified module, which is more cost effective, easier to assemble, and has a lower profile. Because the socket module 8 does not include a floor, the alignment plate 10 can move vertically downward to the position where it reaches the printed circuit board 12. If the socket module contained a floor, the alignment plate would only have the vertical clearance to reach the top of the floor. This would also create a situation where the tab and pin terminals would require a longer length upstanding into the socket module causing greater probability of stubbing and/or damage to the contacts, as well as increased material cost. Moreover, due to the nonexistence of the floor on the module housing, the design is greatly simplified and assembly is made much simpler.